

In re Patent Application of
LA ROSA ET AL.
Serial No. Not Yet Assigned
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In the Claims:

This listing of claims replaces all prior versions and listing of claims in the application.

Claims 1-10 (canceled).

11. (New) A virtual sensor for exhaust emissions from a fuel-injected engine having a combustion chamber in each cylinder, at least one fuel injector serving the combustion chambers, at least one pressure sensor mounted in at least one combustion chamber of the engine, and an electronic fuel-injection control unit, the virtual sensor comprising:

a first input interface receiving a pressure signal from the at least one pressure sensor mounted in the at least one combustion chamber of the engine;

a second input interface receiving fuel-injection signals from the electronic fuel-injection control unit; and

a calculation block generating estimates of amounts of emissions based on the pressure signal and the fuel-injection signals.

12. (New) The virtual sensor according to Claim 11, wherein the fuel-injection signals are measurements of engine operation parameters comprising at least one of crank angle and injection start time.

13. (New) The virtual sensor according to Claim 11, further comprising a signal extraction block connected between the first input interface and the calculation block to extract

In re Patent Application of
LA ROSA ET AL.
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the pressure signal.

14. (New) The virtual sensor according to Claim 11, further comprising a signal processing block connected between the second interface and the calculation block.

15. (New) The virtual sensor according to Claim 11, wherein the calculation block operates according to a soft computing model.

16. (New) The virtual sensor according to Claim 11, wherein the calculation block comprises a neuro-fuzzy processor.

17. (New) The virtual sensor according to Claim 11, wherein the calculation block comprises at least four inputs and two outputs, the inputs receiving signals corresponding to a maximum pressure and a mean pressure as measured by the sensor, combustion start time and injection start time.

18. (New) The virtual sensor according to Claim 17, wherein the outputs are electric signals corresponding to an estimate of nitrogen compounds and particulates in the emissions from the engine.

19. (New) A fuel injection control system for a fuel injection endothermic engine having a combustion chamber in each cylinder, at least one fuel injector serving the combustion chambers, and an electronic fuel-injection control unit, the system comprising:

In re Patent Application of
LA ROSA ET AL.
Serial No. Not Yet Assigned
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at least one pressure sensor in at least one combustion chamber; and

a virtual sensor comprising

a first input interface receiving a pressure signal from the at least one pressure sensor,

a second input interface receiving fuel-injection signals from the electronic fuel-injection control unit, and

a calculation block generating estimates of amounts of emissions based on the pressure signal and the fuel-injection signals.

20. (New) The system according to Claim 19, wherein the fuel-injection signals are measurements of engine operation parameters comprising at least one of crank angle and injection start time.

21. (New) The system according to Claim 19, wherein the virtual sensor further comprises a signal extraction block connected between the first input interface and the calculation block to extract the pressure signal.

22. (New) The system according to Claim 19, wherein the virtual sensor further comprises a signal processing block connected between the second interface and the calculation block.

23. (New) The system according to Claim 19, wherein the calculation block operates according to a soft computing model.

In re Patent Application of
LA ROSA ET AL.
Serial No. Not Yet Assigned
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24. (New) The system according to Claim 19, wherein the calculation block comprises a neuro-fuzzy processor.

25. (New) The system according to Claim 19, wherein the calculation block comprises at least four inputs and two outputs, the inputs receiving signals corresponding to a maximum pressure and a mean pressure as measured by the sensor, combustion start time and injection start time.

26. (New) The system according to Claim 25, wherein the outputs are electric signals corresponding to an estimate of nitrogen compounds and particulates in the emissions from the engine.

27. (New) The system according to Claim 19, wherein the engine comprises a common-rail diesel engine.

28. (New) A method of determining exhaust emissions from a fuel-injected endothermic engine having a combustion chamber in each cylinder, at least one fuel injector serving the combustion chambers, at least one pressure sensor mounted in at least one combustion chamber of the engine, and an electronic fuel-injection control unit, the method comprising:

obtaining a pressure signal from the at least one pressure sensor mounted in the at least one combustion chamber of the engine;

obtaining fuel-injection signals from the electronic fuel-injection control unit; and

In re Patent Application of
LA ROSA ET AL.
Serial No. Not Yet Assigned
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generating estimates of amounts of emissions based on the pressure signal and the fuel-injection signals.

29. (New) The method according to Claim 28, wherein the fuel-injection signals are measurements of engine operation parameters comprising at least one of crank angle and injection start time.

30. (New) The method according to Claim 28, wherein providing estimates comprises operating a calculation block according to a soft computing model.

31. (New) The method according to Claim 30, wherein the calculation block comprises a neuro-fuzzy processor.

32. (New) The method according to Claim 31, wherein the calculation block comprises at least four inputs and two outputs, the inputs receiving signals corresponding to a maximum pressure and a mean pressure as measured by the sensor, combustion start time and injection start time.

33. (New) The method according to Claim 32, wherein the outputs are electric signals corresponding to an estimate of nitrogen compounds and particulates in the emissions from the engine.